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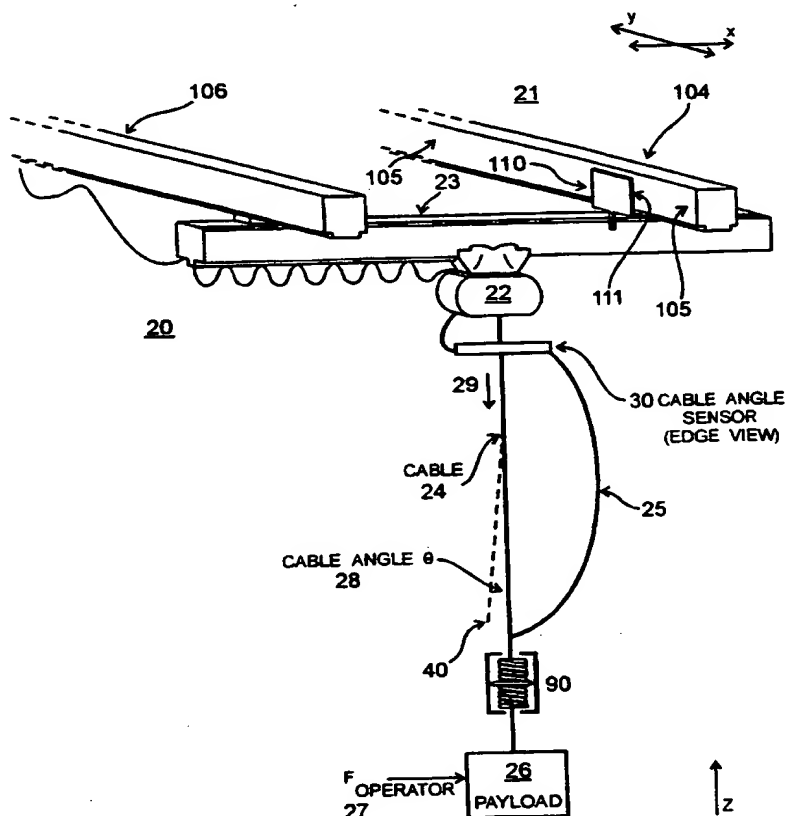
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(71) Applicant (for all designated States except US): **NORTH-WESTERN UNIVERSITY** [US/US]; 633 Clark Street, Evanston, IL 60208 (US).

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(54) Title: **NON-CONTACTING SENSORS**



(57) Abstract: A system and method for measuring the deflection angle of a cable from an initial position is disclosed. The cable is energized with an alternating electric current that creates a magnetic field associated with the cable. Pickup coils are positioned adjacent to the cable and oriented to measure the deflection of the cable in different directions. In an initial position, the magnetic field of the cable is parallel with and does not interact with pickup coils. In the deflected position, the magnetic field of the cable intersects and interacts with the pickup coils. The interaction of the magnetic field with the pickup coils induces a voltage in the pickup coils that indicates the angle of deflection of the cable. Also disclosed are methods and devices for providing a more durable and rugged sensor capable of detecting forces along a single axis. Still other embodiments disclose methods and devices for determining the orientation of a surface or object with respect to another surface.

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## INTERNATIONAL SEARCH REPORT

International Application No.

PCT/US 00/03144

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G01B7/312 B66C13/06 G01L1/14 G01D5/243 G01D5/20  
G01D5/22

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G01B B66C G01L B66D G01D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

WPI Data, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A Y	US 5 350 075 A (KAHLMAN STURE) 27 September 1994 (1994-09-27) abstract; figures 3-8 column 2, line 29 -column 4, line 57 ---	25 1-24 33,49,50
X A	US 5 502 379 A (HANSEL JOZEF ET AL) 26 March 1996 (1996-03-26) the whole document  column 2, line 29 -column 4, line 57 ---	1-5, 10-12 6-9, 13-25
X A	GB 641 674 A (URMENYI, LASZLO) 16 August 1950 (1950-08-16) page 3, line 37 -page 5, line 17; figures 1-3  --- -/--	1,2, 10-12 3-9, 13-25



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

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- "E" earlier document but published on or after the international filing date
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- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

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# INTERNATIONAL SEARCH REPORT

International Application No.

PCT/US 00/03144

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 17 56 441 A (DEMAG AG) 30 April 1970 (1970-04-30) the whole document ---	1-25
Y	DE 32 05 705 A (TRAENKLER HANS ROLF PROF DR IN; SCHILLINGER JAKOB DIPL ING) 25 August 1983 (1983-08-25) the whole document ---	25, 27, 33, 50
A		26, 28-32, 51, 52
Y	DE 22 11 359 A (HONSBERG & CO KG) 13 September 1973 (1973-09-13) the whole document ---	25, 27, 33, 50
A		26, 28-32, 51, 52
Y	GB 1 557 867 A (TEKFLO LTD) 12 December 1979 (1979-12-12) page 3, line 66 -page 4, line 70; claim 14; figure 1 ---	25, 27
A		26, 28-32
X	EP 0 305 591 A (WEIDMUELLER C A GMBH CO) 8 March 1989 (1989-03-08) abstract; figures 1-4 column 6, line 56 -column 8, line 37 ---	34-36
Y		49, 50
A		37-48
X	US 4 906 924 A (ZANNIS JAMES) 6 March 1990 (1990-03-06) figure 13 abstract -----	34, 35
Y		49, 50
A		36-48

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US 00/03144

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-25

An apparatus for measuring the deflection of a support member, wherein a magnetic field is supplied to the support member and a plurality of coils are positioned adjacent to the support member to detect that field.

2. Claims: 25-33, 50-52

A user manipulatable handle measuring the deflection of a spring in order to determine the vertical forces applied to the handle.

3. Claims: 34-49

A parallel orientation sensor for detecting a deviation in the orientation of a sensor pad with respect to a reference surface.



# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 00/03144

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5350075 A	27-09-1994	AU 5630190 A DE 69022850 D DE 69022850 T EP 0471026 A FI 100964 B SE 466960 B SE 9000003 A WO 9013508 A US 5850928 A	29-11-1990 09-11-1995 14-03-1996 19-02-1992 31-03-1998 04-05-1992 03-11-1990 15-11-1990 22-12-1998
US 5502379 A	26-03-1996	FR 2704056 A EP 0621457 A JP 7128132 A DE 69405037 D DE 69405037 T ES 2107777 T PL 173514 B	21-10-1994 26-10-1994 19-05-1995 25-09-1997 26-02-1998 01-12-1997 31-03-1998
GB 641674 A		NONE	
DE 1756441 A	30-04-1970	NONE	
DE 3205705 A	25-08-1983	NONE	
DE 2211359 A	13-09-1973	NONE	
GB 1557867 A	12-12-1979	NONE	
EP 0305591 A	08-03-1989	AT 49471 T DE 3381095 D EP 0098238 A	15-01-1990 15-02-1990 11-01-1984
US 4906924 A	06-03-1990	DE 3772754 A EP 0288517 A WO 8803640 A JP 1501249 T	10-10-1991 02-11-1988 19-05-1988 27-04-1989

